Job Loss Analysis

Control No: _____ **Status:** _____ **Original Date:** 11 May 2009

Last Date Closed:

Organization: Global Manufacturing

JLA Type: Global Mfg Shared

Work Type: Technical Process Engineering

Work Activity: Hydraulic Calculations – modifications to existing piping systems

Personal Protective Equipment (PPE)

☒	Goggles	☒	Hearing Protection	☐	Warning Device	☒	Gloves(Nitrile, rubber, leather)
☐	Face Shields	☒	Hard Hat	☐	Tagout/Lockout kit	☐	Other Barrier tape
☒	Safety Glasses	☒	Safety Shoes	☒	Hi Viz Jacket	☐	Other _____
☐	Safety Back Belt	☐	Safety Cones	☐	Welding Hood	☐	Other _____

Reviewers

Reviewer Name	Position	Date Approved
Ben Diment	Lead Process Engineer – Projects / B&S	19/Apr/2010
Andrew P Waterman	Lead Process Engineer – White Oils	19/Apr/2010
Allan Zieber	Salt Lake Lead Process Engineer	8/15/2010
Jimmy Lam	Senior Process Engineer	5/17/2010
Michelle Johansen	Process Engineering Manager/Global JLA Team Lead	12/14/2010

Development Team

Development Team Member Name	Primary Contact	Position
Awais Ahmed	X 2786	Process Engineer (Project)
Andrew P Waterman	X 2461	Lead Process Engineer – White Oils
E Theron	X3986	Process Engineer

Prerequisites & Technical References

1. Ensure the familiarity with the following technical references.
   a. GEMS Book 2, Class J
   b. Piping – Design GEMS J-1D23
   c. Chevron Engineering Standards (CES) – Fluid Flow Gray Manual

d. Unit of Measure TEC/PRO/036

2. PEM- Standard Calculation Workbook or standard calculation program/site tool

№	Job Steps	Potential Hazard	Critical Actions
1.	Get the relevant P&IDs from the drawing office and ensure that they are the latest revision.	1. P&IDs may not have been updated, or you do not have the latest revision.	1.Highlight the relevant area and mark up the sections requiring site survey.
2.	Get all the relevant isometrics from the drawing office and ensure that they are the latest revision.	1. Isometrics not available. 2. Isometrics not as per P&IDs 3. Isometrics containing a mix of Metric & English units.	1. Conduct a site survey & draw an isometric sketch if one is not available. Engage a piping designer if; • Significant accuracy is required. • Pipe circuitry is complex enough. 2. Highlight the relevant piping route & mark up the areas requiring further clarification upon a site survey. 3. Using the correct conversion factors, convert relevant points on isometrics into their respective Metric equivalents.
3.	Get the relevant datasheets & performance curves from the drawing office (e.g. Datasheets for pumps, control valve, Orifice Plate, Vessel etc).	1.Datasheets and/or Performance Curve not available or incorrect revisions.	1.Ensure datasheets are up to date, if not; contact the vendor (quoting the serial number written on datasheet and/or equipment name plate) for a copy of the datasheet or a curve.
4.	Conduct a site survey (line walk) comparing the engineering drawings (P&IDs, Isometrics, Datasheets etc) with actual piping setup.	1. Line walking a wrong system. 2. Relying too much on either of the two technical documents (P&IDs & Iso) may end up in wrong assessment.	1. Request operational support if the line-walk is complex & not possible. 2. Clarify conflicting info by drawing a rough schematic around the affected area as highlighted in Critical Actions 1.2 & 2.1. i. Roughly compare the piping lengths (For more accuracy use measuring devices), pipe fittings, off takes & pipe elevations against the isometrics. ii. Note down the equipment details to later compare it with the equipment datasheet.
5.	Start compiling a list of related references & assumptions required for the calculation.	1. Without a clear list of the both, it would be difficult for someone to check the logic behind the assessment and thereby approve the accuracy of the calculation. Furthermore, if the calculation is re-visited in future, it will be quite difficult for someone to follow the originator's work.	1. Compile a concise and accurate list of references & assumptions. Update the list as the calculation progresses.
6.	Obtain the fluid physical properties: (density, temperature, viscosity, vapour pressure, heat capacity, etc.)	1.Incorrect fluid properties will result in inaccurate hydraulic calculations & conclusion.	1a.Ensure that the fluid properties being used aren't varying based on different operating modes. If so, consider various valid scenarios for calculation purposes. 1b.If a sample data is being used for property estimation, then it needs to be ensured that it represents the actual plant operation and not process upset conditions.
7.	Sub-divide the line circuitry up into further piping segments.	1.The lack in proper hydraulic modelling may lead to an inaccurate conclusion	1.Subdivide the piping circuit into smaller piping segments based on; • line size changes • junctions with other lines • & points where pressure checks are required (e.g. new tie-in points)
8.	1.Determine the pipe properties in terms of Pipe ID, roughness, insulation (if any), schedule & other fittings (e.g. strainer, static mixer, etc)	Inaccurate piping details can lead to a over/under design state and can easily jeopardise the whole design process.	1.Determine the piping spec per P&ID and/or piping Isometrics. Use PMSS in GEMS-Book 2 (Piping & Valves) to determine the pipe schedule & material for pipe roughness & pipe id. Note: a. If the subject pipe spec refers to an old/obsolete piping class, use Table 3 of GEMS J-2D4 to determine an equivalent valid pipe class. B .Pipe ID can be determined using Table 1 & 2 of FFM 6000-C (Design Properties of Pipe – Chevron Gray Manual).

			c. Figure 400-2 FFM 400 (Frictional Pressure Drop – Chevron Gray Manual) can be use to determine pipe roughness against piping material from the pipe calcs.
9.	Calculate the line equivalent lengths (based on different pipe fittings) & elevation gradients.	1.Inaccurate line lengths & elevations can result in over/under design scenarios.	1.Use approved site standards to calculate equivalent lengths. Apply accurate elevation gradient while doing the calculation.
10.	If new line(s)/tie-ins are being added to the existing pipe-work, correct data is needed to be established for the system (e.g. line lengths, tie-in location elevations, fittings, instruments etc.).	1.Inaccurate line lengths & elevations can result in over/under design scenarios.	1a. A clear sketch with defined nodes will assist in ensuring the usage of correct line information in terms of lengths, elevations & fittings. 1b. Engage a piping designer if • significant accuracy is required • Piping circuitry is complex
11.	Use the site approved Hydraulic Calculation Tool to simulate the hydraulics.	1.Incorrect / unapproved Hydraulic Calculation Tool may result in inaccurate results.	1a. Ensure that the right site-authorized hydraulic calculation template is being used for calculation purposes. 1b. Ensure that the user is familiar with the tool capabilities and understand the limitations set-out by the tool.
12.	Document the calculation steps carefully and accurately.	1. Lack of proper documentation will makes it difficult for an independent checker to actually approve the validity of the calculation.	1.Log calculations steps & assumptions correctly in site standard Calculation Template. (PEM- Standard Calculation Workbook)
13.	Assess the hydraulic calculation results	1.Relying on an inaccurate set of results may lead to a wrong design	1a. Compare the results with actual plant data (Use Pi-DataLink, IndX etc) to validate the results 1b. Sizing Criteria for piping is to be cross-check with GEMS J1D23 & PIM-DU-5138-A.
14.	Document the recommendations / conclusion properly	1. Improper documentation of the conclusions may result in lost effort/results.	1a. Record the recommendations & conclusions appropriately into the Site Standard Calculation Template properly. 1b. For any modification, mark-up the P&IDs (and/or affected Engineering Document) to include within the calculation pack. 1c. For modified/new instruments, prepare instrument datasheet using site approved datasheet templates.
15.	Forward the calculation pack to the Lead Engineer /Senior Engineer for checking & approval.	1. An unauthorized checking & approving body may invalidate calculation findings.	1a. Ensure calculation is checked and approved by an site approved lead or process engineer. 1b. Log the Calculation Check Status in the site approved Calc Register or other local site folder for hydraulic calculations.

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